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Editorial

Non-Precious Metal Electrocatalysts: Synthesis, Characterization and Application

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Electrocatalysis plays a vital role in many chemical processes and is concentrated on improving their efficiency. However, in many cases, in order to accelerate the electrochemical process, it is necessary to use catalysts containing noble metals, such as platinum or palladium. This results in rising the system's capital cost and the price of its products. Thus, many scientific works are dedicated to the development of less expensive and more available catalysts. In the literature, one could distinguish three main approaches in order to achieve this goal [1–3].

The first practice is the employment of carbon-based nanomaterials with large surface area (SA) in the form of hollow spheres, ellipsoids, tubes or nano-structured powders. Although this method could provide us with electrodes possessing a substantial electrochemically active SA, the carbon's inherent electrocatalytic activity is relatively low, compared to that of noble metals. Thus, in order to fully utilize the properties of these electrodes, it is necessary to modify them with more electrocatalytically active materials, such as transition metals. This modification could be carried out by one of the deposition methods, e.g., electrochemical, electroless, chemical vapor deposition (CVD) or physical vapor deposition (PVD) [4,5].

The second method is similar to the previous one; however, various 3-D forms of foams, fibers, nanowires or nanocones are created from one of the commonly available transition metals. This approach could provide us with superior materials to the former ones, because numerous transition metals already possess higher electrocatalytic activity than carbon itself. Additionally, these materials could also be further modified to enhance their electrocatalytic properties by the metal deposition methods mentioned earlier [6,7].

The third approach is focused on forming composite materials with outstanding electrocatalytic properties. Two primary ways to achieve that goal could be found in the literature: one relies on mixing multiple transition metals (MTMs) with inorganic elements (Ca, P, S, etc.), where another deals with forming metal-organic frameworks (MOFs) [8,9].

Mixing MTMs and inorganic elements effectively increases the catalytic activity owing to nano-structuring/crystallization achieved during the process. Furthermore, related oxides are considered promising candidates for making catalysts in large scale applications [8].

MOFs are created through the coordination bonds formed between organic ligands and metals constituents. MOFs are particularly well-known for having high porosity and specific SAs, and crystalline network. However, the most crucial feature of MOFs is their designable structure, which can be tailored for specific applications. Besides, MOFs could be subjected to post-synthetic modification, such as introducing different functional groups to achieve better electrocatalytic properties [9].

This Special Issue aims to cover information on recent progress in the development of relatively inexpensive electrocatalysts that possess enhanced electrochemical activity towards the designated process. Submissions of original research papers, reviews and commentaries are welcome.

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